

What is Claimed Is:

1. An image processing device for generating modified image data by modifying color tones of image of image data; comprising

5 a parameter candidate storage portion that stores a plurality of modification candidate parameters for modifying colors of pixels in image data, the plurality of modification candidate parameters corresponding to mutually differing modifications;

a user interface portion that allows a user to select parameters from among the plurality of modification candidate parameters; and

10 an image converting portion that generates modified image data according to the selected parameter from subject image data that is subject for modification of color tones in image, wherein the modified image data is different from the subject image data in colors of at least part of pixels; wherein

15 the plurality of modification candidate parameters includes:

Nc (where Nc is a positive integer) color image modification candidate parameters for color image data, and

Nm (where Nm is an integer that is larger than Nc) monochrome image modification candidate parameters for monochrome  
20 images; and

the user interface portion

allows the user to select a parameter from the Nc color image modification candidate parameters in case where the subject image data is color image data; and

25 allows the user to select a parameter from the Nm monochrome image modification candidate parameters in case where the subject image data is monochrome image data.

2. An image processing device according to Claim 1, wherein the  
30 plurality of modification candidate parameters are parameters that express characteristics of tone conversion.

3. An image processing device according to Claim 1, further comprising:

a conversion curve preparing portion that prepares according to the selected parameter a conversion curve for producing modification of colors of pixels, the conversion curve providing output tone values corresponding to input tone values,

when the subject image data is monochrome image data, the user interface portion provides a partial adjustment input screen for modifying a second part of the conversion curve without modifying a first part of the conversion curve, the first part being a part in which the input tone values are within a specific range,

the image processing device further comprises a conversion curve modifying portion that modifies the second part of the conversion curve according to user instructions through the partial adjustment input screen, and

the image converting portion produces tone values for pixels of the modified image data by modifying tone values of pixels of the subject image data based on the conversion curve .

4. An image processing device according to Claim 3, wherein the second part is a part corresponding to an area of the input tone values, the area being included in a range of up to top 40% of scope of the input tone values.

5. An image processing device according to Claim 3, wherein the second part is a part corresponding to an area of the input tone values, the area being included in a range of up to bottom 25% of scope of the input tone values.

6. An image processing device according to Claim 4 wherein the conversion curve modifying portion modifies the conversion curve so that

change in the output tone value of the conversion curve is within a range of  $\pm 10$  when expressed as the "L\*" in an "L\*a\*b\*" color coordinate system.

7. An image processing device according to Claim 4 further comprising:

a medium type input portion that receives information about a type of print medium for printing image of the subject image data; and

a modification range determining portion that determines according to the information about the type of the print medium an allowable range of modifications of the output tone values of the conversion curve by the conversion curve modifying portion; wherein

the conversion curve modifying portion modifies the conversion curve so that sizes of the changes in the output tone values of the conversion curve are within the allowable range.

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8. An image processing device according to Claim 3, wherein the conversion curve modifying portion modifies the second part of the conversion curve so that a highest value in scope of the input tone values is converted into a lower value than a highest value in scope of the output tone values.

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9. An image processing device according to Claim 3, wherein the conversion curve modifying portion modifies the second part of the conversion curve so that a lowest value of in scope of the input tone values is converted into a higher value than a lowest value in scope of the output tone values.

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10. An image processing device according to Claim 3, wherein the monochrome image data is image data in which brightness of each pixel is expressed by a tone value,

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the image processing device further comprises a conversion table generating portion that generates a monochrome image conversion table

according to the conversion curve when the subject image is monochrome image data;

the monochrome image conversion table is a conversion table for converting the monochrome image data into image data expressed by tone values in a specific first color coordinate system, wherein conversion with the monochrome image conversion table converts at least a part of achromatic colors expressed by tone values into colors with different brightnesses; and

the image converting portion converts the subject image data into the modified image data based on the monochrome image conversion table when the subject image data is monochrome image data.

11. An image processing device according to Claim 10, wherein the color image data is image data in which color of each pixel is expressed by tone values in a second color coordinate system,

the conversion table generating portion generates a color image conversion table according to the conversion curve when the subject image data is color image data;

the color image conversion table is a conversion table for converting the color image data into image data expressed by tone values in a third color coordinate system that is different from the second color coordinate system, wherein conversion with the color image conversion table modifies at least part of colors expressed by the tone values in the second color coordinate system into other colors;

the color coordinate system converting portion converts the subject image data into the modified image data based on the color image conversion table when the subject image data is color image data;

the third color coordinate system is a color coordinate system in which tone values can be any of  $M_c$  (where  $M_c$  is a positive integer) mutually differing values; and

the first color coordinate system is a color coordinate system in which tone value can be any of  $M_m$  (where  $M_m$  is an integer larger than  $M_c$ ) mutually differing values.

5           12.       An image processing device according to Claim 10, wherein the monochrome image conversion table is a conversion table that includes a part in which, when colors are expressed in an “ $L^*a^*b^*$ ” color coordinate system, the “ $L^*$ ” value of a color that is modified according to the conversion curve is incremented linearly relative to increments in the  
10       input tone value that expresses color prior to modification.

13.       A method for generating modified image data by modifying color tones of image of image data comprising steps of:

          (a)       selecting a parameter from a plurality of modification  
15       candidate parameters for modifying colors of pixels in image data, the plurality of modification candidate parameters corresponding to mutually differing modifications; and

          (b)       generating modified image data according to the selected parameter from subject image data that is a subject for modifications of  
20       color tones in image, wherein the modified image data is different from the subject image data in colors of at least part of pixels, wherein,

          the plurality of modification candidate parameters includes:

$N_c$  (where  $N_c$  is a positive integer) color image modification candidate parameters for color image data; and

25        $N_m$  (where  $N_m$  is an integer that is larger than  $N_c$ ) monochrome image modification candidate parameters for monochrome images; and

          the process (a) includes:

          (a1)       selecting the parameter from the  $N_c$  color image modification candidate parameters in case where the subject image data is color image  
30       data; and

(a2) selecting the parameter from the Nm monochrome image modification candidate parameters when the subject image data is monochrome image data.

5           14.       A method according to Claim 13, further comprising:

          (c)       preparing according to the selected parameter a conversion curve for producing modification of colors of pixels, the conversion curve providing output tone values corresponding to input tone values, the step (a) includes

10           providing to a user a partial adjustment input screen for modifying a second part of the conversion curve without modifying a first part of the conversion curve, when the subject image data is monochrome image data, the first part being a part in which the input tone values are within a specific range,

15           the method further comprising

          (d)       modifying the second part of the conversion curve according to user instructions through the partial adjustment input screen, and the step (b) includes producing tone values for pixels of the modified image data by modifying tone values of pixels of the subject image data based on the conversion curve.

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15.       A method according to Claim 14, wherein

          the step (d) includes modifying the second part of the conversion curve so that a highest value in scope of the input tone values is converted into a lower value than a highest value in scope of the output tone values.

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16.       A method according to Claim 14, wherein

          the step (d) includes modifying the second part of the conversion curve so that a lowest value of in scope of the input tone values is converted into a higher value than a lowest value in scope of the output tone values.

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17. A computer program product for generating modified image data using a computer by modifying color tones of image of image data comprising:

a computer-readable medium; and

5 a computer program that is stored on the computer-readable medium, wherein

the computer program is capable of achieving on a computer:

a function for allowing a user to select a parameter from a plurality of modification candidate parameters for modifying colors of pixels in

10 image data, the plurality of modification candidate parameters corresponding to mutually differing modifications; and

a function for generating modified image data according to the selected parameter from subject image data that is a subject for modifications of color tones in image, wherein the modified image data is  
15 different from the subject image data in colors of at least part of pixels, wherein

the plurality of modification candidate parameters includes:

Nc (where Nc is a positive integer) color image modification candidate parameters for color image data, and

20 Nm (where Nm is an integer that is larger than Nc) monochrome image modification candidate parameters for monochrome images; and

on the computer, the computer program is further capable of:

allowing the user to select the parameter from the Nc color  
25 image modification candidate parameters in case where the subject image data is color image data; and

allowing the user to select the parameter from the Nm monochrome image modification candidate parameters in case where the subject image data is monochrome image data.

30 18. A computer program product according to Claim 17, wherein

the computer program is further capable of preparing according to the selected parameter a conversion curve for producing modification of colors of pixels on the computer, the conversion curve providing output tone values corresponding to input tone values,

5           the function for allowing the user to select a parameter includes  
            a function for providing to the user a partial adjustment  
input screen for modifying a second part of the conversion curve without  
modifying a first part of the conversion curve, when the subject image data  
is monochrome image data, the first part being a part in which the input  
10       tone values are within a specific range,

            on the computer, the computer program is further capable of  
achieving a function for modifying the second part of the conversion curve  
according to user instructions through the partial adjustment input screen,  
and

15           the function for generating modified image data includes a function  
for producing tone values for pixels of the modified image data by  
modifying tone values of pixels of the subject image data based on the  
conversion curve .

20           19.   A computer program product according to Claim 18, wherein  
            the function for modifying the second part includes a function for  
modifying the second part of the conversion curve so that a highest value  
in scope of the input tone values is converted into a lower value than a  
highest value in scope of the output tone values.

25           20.   A computer program product according to Claim 18, wherein  
            the function for modifying the second part includes a function for  
modifying the second part of the conversion curve so that a lowest value of  
in scope of the input tone values is converted into a higher value than a  
30       lowest value in scope of the output tone values.